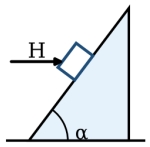
Day 262 **A Level Maths: S Tier 10-a-day**

1 A particle of weight 90 N rests on a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{4}{3}$ and $\mu = 0.5$.
A horizontal force H N, in the vertical plane through a line of greatest slope, holds it in equilibrium. Find the range of possible values of H.



2 Data satisfy $y = ab^x$. The line of best fit for lg y against x is lg y = 0.35 + 0.6x.
(a) Find a and b to 3 significant figures.
(b) Estimate y when x = 19, to 3 significant figures.
(c) Interpret the value of b.

3 A car of mass 1500 kg tows a trailer of mass 600 kg along a horizontal road, with driving force 1950 N. Resistances are 300 N on the car and 600 N on the trailer.
(a) Find the tension in the tow bar. At 6 m s^{-1} the tow bar breaks. (b) Find the distance between car and trailer when the trailer stops.

4 (a) Show that $\frac{\sin 2\theta}{1 + \cos 2\theta} \equiv \tan\theta$.
(b) Hence solve $\frac{\sin 2\theta}{1 + \cos 2\theta} = \frac{1}{3}$ for $0 \leq \theta <$ 360° (1 d.p.).

5 A bag has 2 red counters and some black counters, n in total.
Two are taken without replacement. P(at least one red) = $\frac{13}{28}$. Find n.

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6 The curve C has equation $x^2y + xy^2 = 6$. Find the equation of the normal to C at the point (1, 2), in the form $ax + by + c = 0$ with integers a, b, c.	
7 $f(x) = \frac{kx + 9}{x - 5}$ for $x \neq 5$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.	
8 Find the coefficient of x^4 in the expansion of $(x - 3)(1 + 4x)^5$.	
9 (a) Express $\frac{-7x - 31}{(x + 5)(x + 4)}$ in partial fractions. (b) Hence find the exact value of $\int_0^1 \frac{-7x - 31}{(x + 5)(x + 4)}\,dx$.	
10 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 4x^2 - 40x + 107$.	